

# Safety Data Sheet

# 1,1-Dimethyl- hydrazine

Division of Safety  
National Institutes  
of Health



## WARNING!

THIS COMPOUND IS ABSORBED THROUGH THE SKIN AND THE RESPIRATORY AND INTESTINAL TRACTS. IT IS TOXIC, CARCINOGENIC, MUTAGENIC, AND TERATOGENIC. IT IS FLAMMABLE AND EXPLOSIVE AND MAY IRRITATE TISSUES. AVOID FORMATION AND BREATHING OF AEROSOLS AND VAPORS.

LABORATORY OPERATIONS SHOULD BE CONDUCTED IN A FUME HOOD, GLOVE BOX, OR VENTILATED CABINET.

AVOID SKIN CONTACT: IF EXPOSED, WASH WITH SOAP AND WATER.

FOR EYE EXPOSURE, IRRIGATE IMMEDIATELY WITH LARGE AMOUNTS OF WATER. FOR INGESTION, DRINK PLENTY OF MILK OR WATER. INDUCE VOMITING. FOR INHALATION, REMOVE VICTIM PROMPTLY TO CLEAN AIR. ADMINISTER RESCUE BREATHING IF NECESSARY. REFER TO PHYSICIAN.

IN CASE OF LABORATORY SPILL, WEAR PROTECTIVE CLOTHING DURING CLEANUP. AVOID SKIN CONTACT OR BREATHING OF AEROSOLS OR VAPORS. USE WATER TO DISSOLVE COMPOUND. WASH DOWN AREA WITH SOAP AND WATER. DISPOSE OF WASTE SOLUTIONS AND MATERIALS APPROPRIATELY.

### A. Background

1,1-Dimethylhydrazine (UDMHZ) is a colorless, volatile, hygroscopic liquid with an ammonia-like odor; it is flammable and easily oxidized by atmospheric oxygen. It is corrosive to skin, a respiratory irritant in man and animals, toxic and carcinogenic in laboratory animals, and mutagenic in microorganisms. Its principal commercial use is as rocket fuel, but it has also been used as intermediate in the production of plant growth regulators, fuel additive stabilizers, and photographic chemicals.

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## Chemical and Physical Data

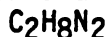
1. Chemical Abstract No.: 57-14-7

2. Synonyms:

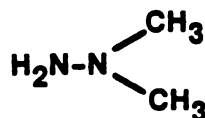
|                              |                         |
|------------------------------|-------------------------|
| UDMHZ                        | 1,1-Dimethylhydrazine   |
| Dimazine                     | Unsym-Dimethylhydrazine |
| Dimethylhydrazine            | N-N-Dimethylhydrazine   |
| Asymmetric dimethylhydrazine |                         |

3. Molecular

formula:



structure:



weight:

60.12

4. Density: 0.791 g/cm<sup>3</sup>.

5. Absorption spectroscopy: IR, Raman, and MS spectra are listed by Grasselli and Ritchey (1975).

6. Volatility: Vapor pressure = 156.8 mm Hg at 25°C; 10 mm Hg at -22°C.

7. Solubility: Very soluble in water, ethanol, ether, dimethylformamide, and hydrocarbon solvents.

8. Description, appearance, and odor: Colorless, volatile, hygroscopic liquid with ammonia-like odor. Fumes in air and gradually turns yellow.

9. Boiling point: 63.9°C.

Melting point: -57°C.

10. Stability: UDMHZ vapors are highly flammable in air and ignite spontaneously when in contact with oxidizing agents. Solutions of UDMHZ are relatively stable when stored in the dark under refrigeration.

11. Chemical reactivity: UDMHZ forms salts with mineral acids. As a strong reducing agent, it is oxidized by compounds such as peroxides, iodates, ferricyanide, and ceric ions in acid solution.

13. Autoignition temperature: 249°C.
14. Flammable limits in air: No data.

#### Fire, Explosion, and Reactivity Hazard Data

1. Use large amounts of water to extinguish fires and to minimize reignition and flashback hazard. Fire-fighting personnel should wear air-supplied respirators with full-face masks.
2. UDMHZ is highly flammable and its vapors in air can produce explosive mixtures.
3. Conditions contributing to instability include exposure to atmospheric oxygen, heat, and ultraviolet light.
4. Incompatible with oxidizing agents and metallic oxides.
5. Incomplete oxidation may result in hazardous decomposition products (hydrogen, ammonia, dimethylamine, hydrazoic acid).
6. Do not expose to sparks or open flames. Use nonspark tools. Store in an explosion-safe refrigerator only.

#### Operational Procedures

The NIH Guidelines for the Laboratory Use of Chemical Carcinogens describe operational practices to be followed when potentially carcinogenic chemicals are used in NIH laboratories. The Guidelines should be consulted to identify the proper use conditions required and specific controls to be implemented during normal and complex operations or manipulations involving UDMHZ.

HZ penetrates various glove materials (Luskus et al., 1980). This factor should be taken into account when handling UDMHZ.

1. Chemical inactivation: No validated method reported.
2. Decontamination: Turn off equipment that could be affected by UDMHZ or the materials used for cleanup. If more than 10 ml has been spilled or if there is any uncertainty regarding the procedures to be followed for decontamination, call the NIH Fire Department (dial 116) for assistance. Wash surfaces with copious quantities of water. Glassware should be rinsed (in a hood) with water and washed with soap and water. Animal cages should be washed with water.
3. Disposal: No waste streams containing UDMHZ shall be disposed of in sinks or general refuse. Surplus UDMHZ or chemical waste streams contaminated with UDMHZ shall be handled as hazardous chemical waste and disposed of in accordance with the NIH chemical waste disposal

system. Nonchemical waste (e.g., animal carcasses and bedding) containing UDMHZ shall be handled and packaged for incineration in accordance with the NIH medical-pathological waste disposal system. Potentially infectious waste (e.g., tissue cultures) containing UDMHZ shall be packaged for incineration, as above. Burnable waste (e.g., absorbent bench top liners) minimally contaminated with UDMHZ shall be handled as potentially infectious waste and packaged for incineration, as above. Absorbent materials (e.g., associated with spill cleanup) grossly contaminated shall be handled in accordance with the chemical waste disposal system. Radioactive waste containing UDMHZ shall be handled in accordance with the NIH radioactive waste disposal system.

4. Storage: Store in sealed ampoules, in bottles with caps having polyethylene cone liners, or in screw-capped vials with Teflon liners in an explosion-safe refrigerator. For long-term storage, a freezer is preferred; however, stocks must be protected against moisture and brought to room temperature prior to sampling to avoid introducing moisture.

#### Monitoring and Measurement Procedures Including Direct Field Measurements and Sampling for Subsequent Laboratory Analysis

1. Sampling: For quantitative measurements of airborne particles or vapors, glass bubblers charged with hydrochloric acid are used. For monitoring purposes, sampling and detection tubes, a personnel monitor (based on reduction of a metal salt and completing an electric circuit), and a dosimeter (colorimetric reaction, Plantz et al., 1968) have been developed; some of these items are commercially available. No special procedures have been developed for water sampling. For surface sampling, Weeks et al. (1976) describe a method whereby a surface swipe is taken with filter paper, which is then moistened with ethanol followed by addition of fluorescence-producing agent.
2. Separation and analysis: Methods developed up to 1970 have been reviewed (Malone, 1970). Colorimetry, involving reaction of UDMHZ with trisodium pentacyanoamino ferroate (TPF), has been applied to determinations in air, blood, and water (Pinkerton et al., 1963). Detection limits are in the range of 1-60  $\mu\text{g/ml}$  of plasma or whole blood. This method is not nearly as much subject to interference by other reductants as is the phosphomolybdic acid procedure in use for other hydrazines. Greater sensitivity has been achieved by means of TLC with the Folin-Ciocalteu reagent (Fiala and Weisburger, 1975).

#### Biological Effects (Animal and Human)

1. Absorption: UDMHZ is readily absorbed through the respiratory and intestinal tracts and through the intact skin. Eye exposure causes severe irritation.

2. Distribution: No data.
3. Metabolism and excretion: UDMHZ is rapidly N-oxidized in vitro (Prough, 1973). Only small amounts are excreted in the urine of dogs after dermal application (Smith and Clark, 1971).
4. Toxic effects: The oral LD50s in the rat and mouse are 122 and 265 mg/kg, respectively; the LC50s for a 4-hour exposure in rat, mouse, and hamster are 252, 172, and 392 ppm, respectively. Symptoms of acute toxicity in man are respiratory irritation (sometimes leading to pulmonary edema), nausea, vomiting, headache, tremors, and weakness. More chronic effects point to liver toxicity. In experimental animals, chronic inhalation studies indicate that the central nervous system (excitation, convulsions), liver (bilirubinemia), and blood (slight hemolytic anemia) are target organs for UDMHZ toxicity.
5. Carcinogenic effects: UDMHZ, when administered in water to mice (the only species studied) over their lifetime, produces tumors in the liver, lungs, kidney, and liver blood vessels.
6. Mutagenic and teratogenic effects: A metabolite of UDMHZ is mutagenic to microorganisms; there is no mutagenicity to mice. A teratogenic effect on toad embryos has been described.

### Emergency Treatment

1. Skin and eye exposure: For skin exposure, remove contaminated clothing and wash skin with soap and water. Avoid raising skin temperature. For eye exposure, irrigate immediately with copious quantities of running water for at least 15 minutes.
2. Ingestion: Drink plenty of milk or water. Induce vomiting.
3. Inhalation: Remove victim promptly to clean air. Administer rescue breathing if necessary.
4. Refer to physician. Ophthalmological consultation and treatment for laryngeal and pulmonary irritation and edema may be required.

### References

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